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EFFECTIVENESS OF THE NAVY MAINTENANCE AND MATERIAL MANAGEMENT SYSTEM AS A MANAGEMENT INFORMATION SYSTEM

by

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CHAPTER I

INTRODUCTION

The Navy Maintenance and Material Management System (3-M) was developed to meet the increasing needs of the Navy to exercise at all levels of management more effective direction, supervision, and control over the maintenance resources (skilled personnel, material, and funds) in support of complex equipments and weapons systems. This system is both a management and a management information system--that is, it is a vehicle by which management control, policy direction, and technical supervision are progressively exercised from one management level to another, and it provides a means by which essential information pertaining to maintenance requirements and accomplishments and maintenance resource requirements and usage can flow between interested managers at all levels.

Background

In January, 1963, the Chief of Naval Operations established the Maintenance and Material Management Project Group in Norfolk, Virginia for the purpose of recommending implementing action to improve the material readiness of the fleet through

better management of the maintenance and the material functions.[1]

Along with the creation of a Maintenance and Material Management Group at Norfolk, two Washington, D. C. based committees were established to coordinate and direct the efforts of the Project Group. These committees were a Steering Committee under the Chairmanship of the Assistant Chief of Naval Operations for Logistics and a subcommittee of the Steering Committee known as the Staff Working Group, to be chaired by the Executive Secretary of the Steering Committee.[2]

The Steering Committee was a policy-making body. It was kept informed of both progress and significant problems in its area of interest through periodic reports by its subcommittee, the Staff Working Group. The primary missions of the Working Group were: (a) The development of a standard maintenance planning and control system that would provide for the uniform accomplishment of planned preventive maintenance in all ships and aircraft squadrons of the operating fleet; and (b) The development of a system for collecting, processing, analyzing, and distributing feedback information that would enable line commanders and bureaus to carry out their management functions better in support of the operating forces.[3]

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[1]U. S., Department of the Navy, Office of the Chief of Naval Operations, Instruction 5420.48, <u>3-M System Project Group and Subordinate 3-M Staff Working Group</u>, 15 January 1963.

[2]<u>Ibid</u>.

[3]<u>Ibid</u>.

In March of 1963, a program to achieve the above objectives was implemented and provided for a time-phased plan of action for the installation of a standard maintenance planning system and a related Maintenance and Material Management Information System.[1]

In order to facilitate the design of the information system, a subcommittee called the Research Study Team under the chairmanship of the Office of Naval Research was established in July, 1963. The membership of the Research Study Team included representatives from the Bureaus (now called Systems Commands), Office of the Chief of Naval Operations, Office of Naval Material, Fleet Work Study Group Atlantic, Office of Naval Research and The George Washington University Logistics Research Project. Basic to the effort of designing an information system was the determination through the device of a formal user survey of the requirement for maintenance and material information at each management and command level.

The concern with functional areas was related to an interest in evaluating data requirement commonality and uniqueness over major management areas: maintenance management per se, material management, personnel management, systems effectiveness management (reliability, maintainability, availability). The assessment of requirements, through the medium of a survey

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[1]U. S., Department of the Navy, Office of the Chief of Naval Operations, Instruction 4700.16C, Standard Navy Maintenance Management System (3-M System), 27 August 1965.

questionnaire, was designed to provide information on:

1. The fundamental level (component, subsystem, system, ship or aircraft, class or type) of aggregation at which particular commands or functional area managers require maintenance information to be reported.

2. The requirement for identification information to particularize:

a. The object of the maintenance action (the hardware entity on which maintenance is being performed).

b. The resources (material and manhours) consumed in maintenance actions.

3. The requirement, by particular commands and functional area managers, for specific data elements which describe the nature of the maintenance action or the operational history of equipments prior to the maintenance action.

4. The requirement, by commands and functional area managers, for timeliness of reporting of maintenance information (daily, weekly, monthly, quarterly, annually, exception basis). Information in this area was essential to the ultimate selection of data processing and communications equipment to effect a full-scale operational information system.

Upon completion of the survey of information requirements, the Research Team recommended the adoption of a basic system consisting of ten maintenance specific data elements and the

immediate development of Master File Data.[1]

The master file data base was to include that information which must be available at a data processing center to interact with the maintenance specific data for the production of desired management reports. The system required direct accessibility to the following types of existing data files:[2]

1. Catalog Files--unit price, unit cube, unit issue, parts nomenclature, Component Identification number (CID) cross reference.

2. Configuration Accounting File.

3. Federal Stock Number Cross Reference File.

4. Planning and Scheduling File--employment schedules, alteration and repair schedules.

5. Manhour Cost Files.

6. Allowance and Load List Files.

The main problem was to effect a required standardization over the many sources which generated or stored and processed these data; to investigate the error structure of the existing files, establish a priority program to effect necessary improvements, and develop and implement control procedures.

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[1] J. E. Hamilton, A Proposed Integrated Navy Ship Maintenance and Material Information System, The George Washington University Logistics Research Project, Technical Paper, Serial T-176, 12 January 1965.

[2] U. S., Department of the Navy, Office of the Chief of Naval Operations, Instruction 4700.22, ADPE Located at SPCC, Mechanicsburg, Pa., 22 April 1966.

The operational requirements for automatic data processing were generated and the basic functions of the computer system were outlined as follows:[1]

1. Create and maintain an audited 3-M Data Base.

2. Validate the 3-M data.

3. Produce validation reports to the fleet for the purpose of corrective feedback.

4. Assimilate non-3-M (Master Data File) data files.

5. Produce and distribute, periodically or on demand, 3-M management reports.

6. Supply, periodically or on demand, subsets of 3-M files to user specification.

Programming was accomplished at The George Washington University[2] and the completed data processing system was accepted by the Maintenance Support Office, Mechanicsburg, Pennsylvania on September 22, 1966.[3]

Purpose and Scope

Since its implementation in 1963, the 3-M System has undergone continuous growth and development. The implementation

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[1]Logistic Research Project Technical Memorandum, Description and Scheduling of Management Products for the Navy Maintenance and Material Management Program, Serial TM-12066, 13 November 1964.

[2]*Ibid.*

[3]Maintenance Support Office letter 301 247, 22 September 1966.

of a system of the magnitude of 3-M, a system which in essence crosses all norm command and support lines and modifies previous management methods, has not been accomplished without some controversy and degree of reservation.

The purpose of this study is to:

1. Examine carefully and comprehensively the effectiveness of the 3-M System in attaining its objectives as a management information system.

2. Assess the value of the 3-M System in providing information necessary for the improvement of the Shipboard Allowance and Load List Program.

3. Examine the contributions and benefits derived thus far from the 3-M System.

4. Consider some of the systems interface problems that exist for the future.

An analysis will be made of the principles and main elements of an integrated management information system, as set forth in the literature by management and data collection processing authorities. This analysis will be used as a basis for evaluating the effectiveness of the 3-M System. Certain areas of the entire system will be examined; however, primary focus will be on the Maintenance Data Collection System (MDCS), a major 3-M subsystem, for support of shipboard installed equipments as opposed to aviation support.

CHAPTER II

MANAGEMENT INFORMATION SYSTEMS

Information Science

Information systems consist of collections of recorded information, custodians who organize and maintain the collections, retrieval procedures, and users. The conceptual foundations for these systems are derived from mathematics, engineering, behavioral science, and the many other disciplines which together make up information science.

An analysis of any information system must begin with an understanding of information science whose theories form the conceptual foundations of information systems.

Information science is the discipline--the theoretical discipline--concerned with the applications of mathematics, systems design, and other information processing concepts. It is an interdisciplinary science, involving the efforts and skills of librarians, logicians, linguistics, engineers, mathematicians, and behavioral scientists. The application of information science results in an information system.[1]

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[1] H. Borko, "The Conceptual Foundations of Information Systems," Paper read at the symposium: The Foundations of Access of Knowledge, Syracuse University, Syracuse, New York, July 28-30, 1965.

According to Peter Drucker,[1] the manager has one specific tool at his disposal--namely, information. He does not handle people; he motivates, guides, organizes people to do their own work. His tool to accomplish all of this is the spoken or written word or the language of numbers.

A formal arrangement for seeking out the critical problems of any organization is a prerequisite to any evaluation of its information problems. In actual practice, the life of the manager is a flood of messages varying in scope and significance. As a "message center," his effectiveness depends on how he arranges for these messages to flow to him and how he filters out the most significant content of the messages received.

The origin of the problem of inadequate management information lies in the gap between a static information system and a changing organizational structure. Many leading companies are suffering a major information crisis--often without fully realizing it. As D. Ronald Daniel points out in his article, "Management Information Crisis," the trouble is that in most companies it is virtually taken for granted that the information necessary for the performance of a manager's duties flows to the job. The cornerstone for building a competent, useful management information system is the determination of each executive's

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[1]Peter Drucker, The Practice of Management (New York: Harper and Row, Inc., 1954), p. 346.

information needs.[1] Unfortunately, most organizational structures do not pin down the responsibility of management information systems nor do they identify it to specific executive positions.

Some organizations have been nearly paralyzed by too much of the wrong information. A management system is created in anticipation of needs that are not fully known. Yet the real measure of the adequacy of a system is its ability to satisfy its users' needs as they arise.

One of the keys to the development of a dynamic and usable system is to move beyond the limits of classical accounting reports and to conceive of information as it relates to two vital elements of the management process, that is, planning and control.

A major challenge to the information system designer lies in trying to integrate the organization's data base so that it can be useful to all of the segments and components of the organization. The purpose of any system is to carry information to a decision maker, while the task of the system's designer is to achieve a balance between the built-in decision mechanisms and the decision that individuals make as a result of the system's output. Emphasis is needed on the processing of information

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[1]D. Ronald Daniel, "Management Information Crisis," in Robert N. Anthony, John Dearden, and Richard F. Vancil, Management Control Systems--Cases and Readings (Homewood, Ill.: Richard D. Irwin, Inc., 1965), pp. 111-112.

requests and the providing of reports on an as required basis, as opposed to a system that produces printouts from a data bank on a routine cycle. Often, the manager cannot assimilate the vast quantities of data that are produced at regular intervals, and often his requests for specific data are met with references to high reprogramming costs and lengthy delays.

To this point in the paper, there has not been a direct reference to computers or any other specific type of data processing equipment. This is to emphasize that possession of data processing equipment is not a prerequisite for a management information system. Such equipment, of course, has opened up new avenues in systems design and greatly enhanced management's capability of coping with information requirement problems. There are some that feel automatic data processing is not an answer in itself. John Dearden contends, for example, that many managers today are making decisions using less than ten percent of the information that would be available to them without computers. However, the faults of many inadequate management information systems cannot be corrected merely by the use of a computer. The computer can be used to automate only certain types of operational control systems. Attempting to automate all of the top-management information requirements is the wrong approach.[1] In many organizations management is concerned with the

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[1] John Dearden, "Can Management Information be Automated?," in Robert N. Anthony, John Dearden, and Richard F. Vancil, Management Control Systems--Cases and Readings (Homewood, Ill.: Richard D. Irwin, Inc., 1965), p. 532.

extent to which computers should be used to automate its information system. A more important concern, however, is the adequacy of the system, particularly in the strategic planning and management control areas. Consequently, it appears that it is vital to examine the quality of the management information system first and to consider automating it second.[1]

There is evidence that many managements in industry today are still reluctant to undertake a formal management information program. Joseph I. Barnett, Vice President of the Standard Program Corporation of New York, attributes this reluctancy to a lack of understanding and the confusion that surrounds the subject of information systems. He feels that contributing to this confusion are accounts, such as those below, that relate the experience of others who have undertaken such a program.

1. Associates in other companies either praising or condemning the results of similar programs undertaken by their organizations. This contradiction becomes more confusing when the reasons given for success or failure differ from person to person.

2. Internal line and staff management personnel stating the absolute necessity for, or violent objection to, such an undertaking with each endorsement or objection supported with valid proof.

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[1]John Dearden, "Management Information Systems and the Computers," in Robert N. Anthony, John Dearden, and Richard F. Vancil, Management Control Systems--Cases and Readings (Homewood, Ill.: Richard D. Irwin, Inc., 1965), p. 519.

3. Presentations by experts in the information processing field pointing out the simplicity or extreme complexity of such an undertaking.

4. The sudden appearance of excessive costs, during or following installation, that were not considered at the time of the original estimates.

5. Underlying fear of personnel that installation of a management information system will uncover weak spots in the organization that could lead to changes affecting them.[1]

Mr. Barnett notes, however, that management is continuously faced with the frustrations of receiving inadequate, incorrect or untimely information. As a result of these frustrations, the more progressive companies are vigorously pursuing the development and installation of information systems. This determination stems from a desire to achieve a stage in information storage, use, and handling that will achieve:

1. Uniformity of information--with a single source generating the required information.

2. Reliability of information--resulting from adequate controls established and constantly monitored on all input and output of the system.

3. On-time response--communication of established information needs as often and as quickly as desired.

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[1]Joseph I. Barnett, "How to Install a Management Information and Control System," Systems and Procedures Journal, XIX (October, 1966), pp. 10-14.

As these items are achieved the benefits from a management information system become evident: the potential for achievement of substantial reductions in operating costs, information that management can refer to quickly and simply to assist in its decision process, and a smoother, more efficient organization that can supply the information when needed.[1]

Information is management information only to the extent to which the manager needs or wants it; and it is significant to him only in terms of its value to his accumulation of relevant knowledge and plans and to his personal responsibility.

Charles T. Meadow in his book entitled The Analysis of Information Systems stresses that the designer of an information system is faced with two major problems relative to system performance: finding user's requirements and interpreting the response he gets when he asks what is wanted, these being clouded by honest inability to state requirements and the unfortunate tendency of some people to try to outguess the designer on the nature of the system that will ultimately be created.[2]

A significant area of systems design is the setting of boundaries, which is a key part of any problem definition. From such a framework we can obtain a realistic grasp of the meaning of information and its flow in management situations. True, there are as many ways to classify information for management purposes as there are management problems, and these are infinite.

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[1] Ibid.

[2] Charles T. Meadow, The Analysis of Information Systems (New York: John Wiley and Sons, Inc., 1967), p. 135.

It is the top management's responsibility to give their managers the best operating information rather than relying solely on controls. Information is worth storing only if there is a definable use for it in solving a pending or foreseeable problem.

In his article, Mr. Barnett describes the steps that management must take prior to installing a system to help insure its successful functioning. Until management feels that these items are in place, or can readily be achieved, it would be best to delay the start of organizational involvement in information systems.

1. Adequate organizational discipline so that common interfunctional procedures can be implemented.

2. Documentation of potential savings anticipated from installation of the system. This documentation must include reasonable supporting data to substantiate the savings, and to justify the investment of company facilities for such an undertaking.

3. A relatively stable management, especially at the policymaking level. Continual reorganization at this level does not have an environment conducive to effective systems design and installation of this nature. Paradoxically, a management information system, if properly designed, will help stabilize an organization as a result of the well defined responsibilities and controls required for such a system.

4. Management that is willing to commit its own time and interest to understand the various plans, techniques and equipment associated with the proposed system. This understanding should be in sufficient detail to enable intelligent monitoring of the costs and progress of the system.

5. The willingness of management to start acquiring and training a core of experienced systems personnel. This core can range in size from one man in a small company to a full staff of twenty or more in a major corporation.

6. The presence within the organization of operational personnel who are knowledgeable in depth concerning the information requirements, methods, procedures, and techniques within the functions they are associated with. These personnel will play a major role in the design and implementation of such a system. Management must be willing to relinquish considerable time from the regular duties of these personnel since they will become members of the design and installation committee.[1]

Information processing has suffered in the past because it was assumed that it was similar to the processing of a physical product. Information must be conceptual in nature. The separation of the concept of information from the physical media upon which the information is carried will be a major breakthrough.

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[1] Barnett, Systems and Procedures Journal.

James D. Gallagher, in his book Management Information Systems and the Computer,[1] states that the ultimate goal of an effective management information system is to keep levels of management completely informed on all developments in the business which affect them. To do this the data-processing personnel and those entering information into the system should know what data to collect and which to tabulate, and management on its part has the obligation to clearly define its actual requirements for internal information.

Timely, adequate and correct information--the means through which management can effectively monitor, control, and plan--is becoming increasingly elusive as organizations grow in size and complexity. The decision to establish formal information systems becomes almost inevitable in today's accelerated climate.

Essentially, the functioning of a management information system involves transmission of all pertinent data (data flows) necessary to the conduct of an organization to one or more management information centers, where it is maintained and then disseminated in discrete form to all levels of management.

Professors John Dearden and F. Warren McFarlan,[2] both of the Harvard Business School, assert that information is not homogeneous and, therefore, different kinds of information must be

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[1](New York: American Management Association, 1961), p. 17.

[2]John Dearden and F. Warren McFarlan, Management Information Systems: Text and Cases (Homewood, Illinois: Richard D. Irwin, Inc., 1967), pp. 4-6.

treated differently. According to them the five important dichotomies of information are:

1. Action and nonaction.
2. Recurring and nonrecurring.
3. Documentary and nondocumentary.
4. Internal and external.
5. Historical and future.

In order to handle effectively the information that is entering, circulating, being generated and leaving a business, it is necessary to organize logical systems for data.

An organization can be viewed as a series of large information networks connecting the requirements for information with the sources of data. In large complex business organizations, the different operations of a given business organization can be described as separate information networks, with one giant overall information network superimposed on top of the individual information networks.

Methods, tools, techniques, and processing equipment have only recently been applied to this management concept, although viewing a business organization as a series of information networks has been expounded by teachers of management for many years.

The Navy is analogous to a complex business organization as it also may be viewed as a series of information networks. To understand the nature of an integrated management information

system in the Navy, present-day problems must be reviewed.

The structure of management information systems is parallel to the management structure. This structure is shown schematically in three levels. (Figure 1)

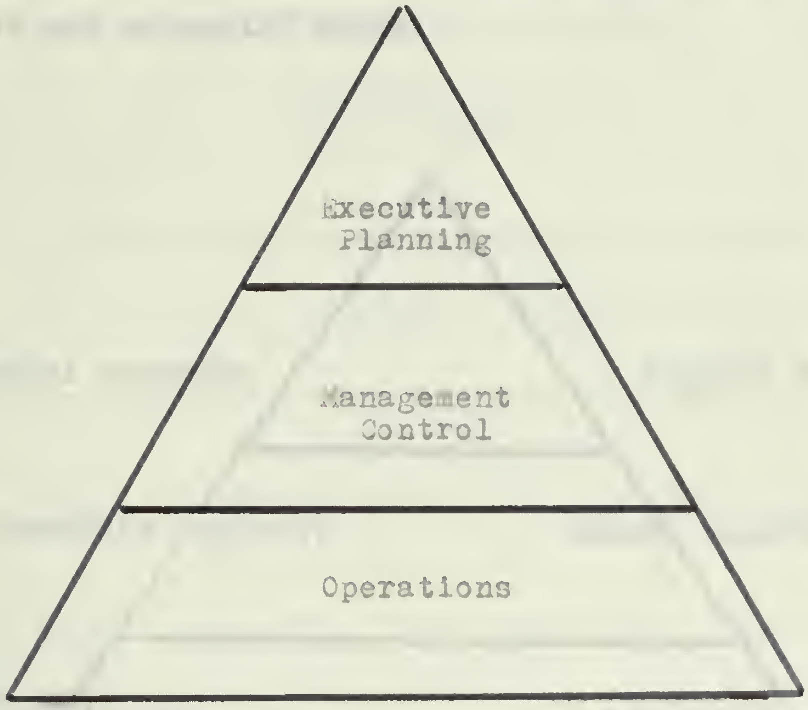

Figure 1.--Hierarchical MIS Structure

In the Navy these three levels might be equated to the Secretarial level, the Command level, and the Operating level. However, it is better not to consider the structure as fixed but to assume that any position of management, either in the military or in industry, may fall into one of the three horizontal categories, depending on the work problem at hand and the related

decision-making requirement.

At the three management levels, three different types of general inputs and outputs of information are required. (Figure 2) These inputs and outputs are inherently different and present systems do not generally provide for vertical aggregation of data from the grass roots into condensed information at the top in any responsive and automated means.

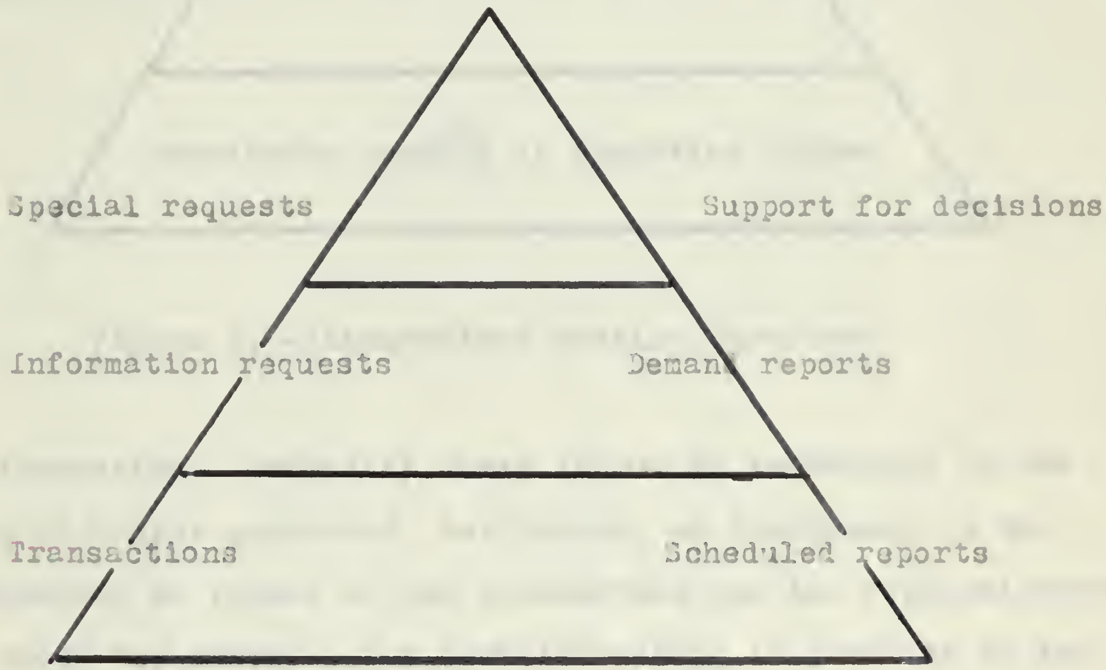

Figure 2.--Typical Input/Output

Not only can the management structure be shown as tri-level but some problems can be structured in a similar manner. (Figure 3) The top level shows inadequate information for

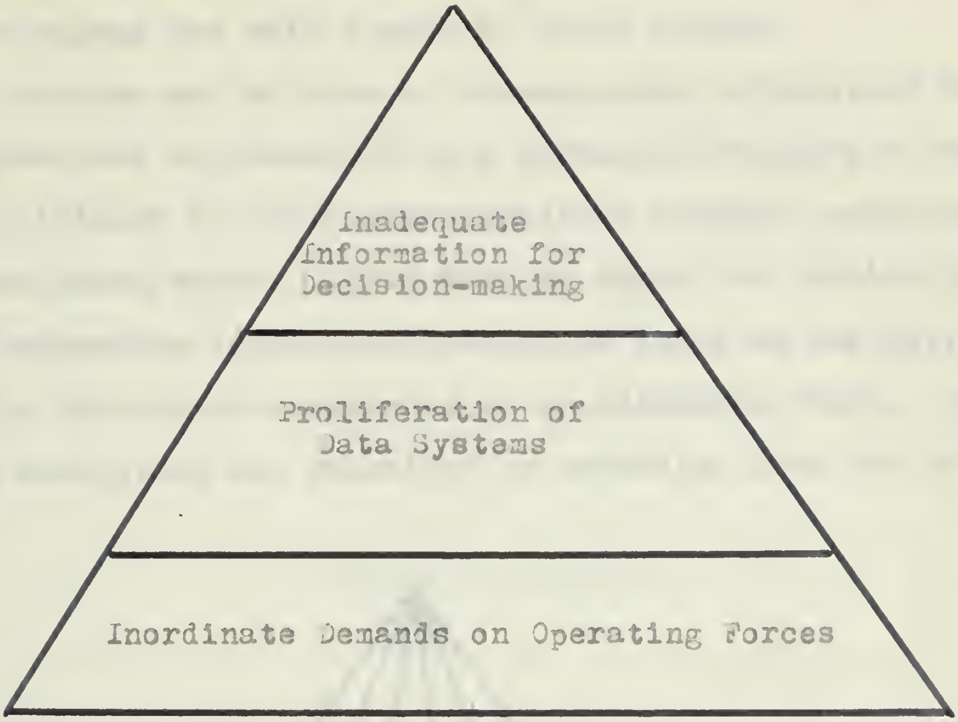

Figure 3.--Hierarchical Problem Structure

decision-making. Certainly there is not an inadequacy in the amount of output generated, but rather, an inadequacy in the presentation or format of the information and the responsiveness with which the material for decision-making is provided to top management. This has been brought about through complexities of warfare, of weapons systems, and management support systems. The requirement for information to support decision-making at the top has resulted in a proliferation of data systems. Currently, there are approximately 500 automated systems in the Navy, few of which are alike, and fewer talking to each other. Because of this

proliferation, inordinate demands are placed on the operating forces to supply the data inputs to these systems.

Another way to look at a management information system and its problems is presented by a vertical structure of subsystems. (Figure 4) As a representative example, note the five subsystems shown below. It is hard to trace the continuity of a vertical subsystem in an organization as large as the Navy, especially through an electronic or an automated chain. However, vertical subsystems are conceived as extending from top to bottom.

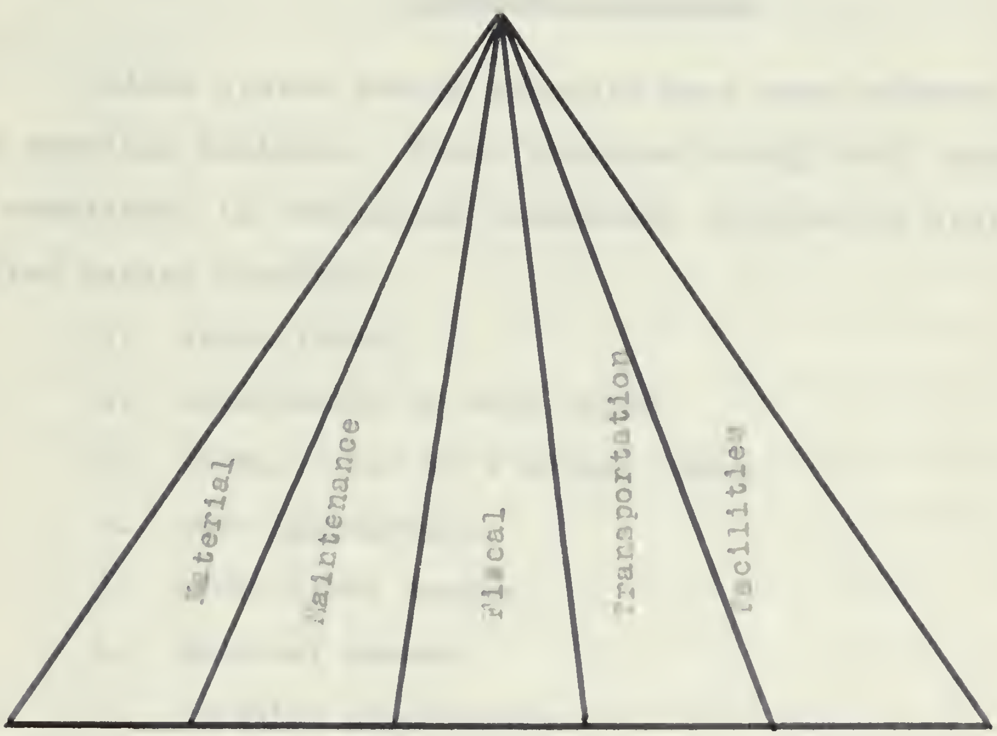

Figure 4.--Vertical Subsystems

Problems associated with vertical subsystems are:

1. Lack of data control.

2. Inability to move data between subsystems.

3. Non-uniformity of procedures and formats. As a result of these problems there is a heavy impact on the operating forces. Redundancy of input and reporting must be alleviated. The system must be dynamic; it must provide levels of aggregation appropriate to the decision level, and techniques for performance evaluation.

Conceptual Approach

Eight system design precepts have been extracted from the previous analysis. These precepts, along with others, must be considered in developing management information systems. System design precepts:

1. Micro input.

2. Integration of data banks.

3. Multiple use of a single input.

4. Data aggregation.

5. Multi-level access.

6. Vertical search.

7. Adaptive capability.

8. Inter/intra service compatibility.

The micro input precept is a short way of saying entry of data into the system, in the smallest elements, at one time, and one place. Implementation of the micro input concept alleviates the reporting burden on the operating level.

An integrated data bank serves as a central depository, or master file for all data collected by the system. Data elements, rather than reports, are sent directly to the bank. This reduction in the amount of data forwarded permits the efficient use of more sophisticated communications. Management reports can be generated either on a routine basis or as required, with the burden shifted from the operating forces to the shore establishment.

The multiple use of a single input means that the data are taken into the system just one time to be used by all segments or subsystems. An alternative method for multiple use of a single input would have interrogation by subsystems that are external to the data bank. The element entering would pick up tags identifying it to the subsystem concerned with retrieval.

Data aggregation can be thought of as a compression of the data as they ascend in the management hierarchy. Management at various levels requires different amounts of detail to support its decision-making process. Data aggregation is a very simple conceptual idea, but it is very difficult to accomplish. A couple of years ago the weight of evidence was against this capability being automated. However, the rapidly advancing

state-of-the-art in computerization will make this task feasible in the near future.

Multi-level access means multiple use of single inputs at all decision levels. The system must provide access to data by all levels of management having a need to know.

Vertical search is not the opposite of aggregation, but it implies the necessity to aggregate. It is the capability of any decision level to search any level of detail or summarization, independent of his position in the organization or management structure. The vertical search concept is again something for which a responsive capability does not presently exist. If, for example, an event is reported to a higher authority who wants to know why the event took place, the response to the query may take an inordinate amount of time. This is not the responsiveness that is needed. Rapid and responsive vertical search for management is a necessity.

The precept of adaptive capability permits a newly stated query to be placed into the system without requiring the whole system to be reprogrammed. There must be alternative ways in which the system may be queried and answers obtained.

Inter/intra service compatibility means that the system must interface with many other management information systems that exist throughout the Department of Defense. A conceptually sound information system is one that permits the integration of a broad spectrum of information which is required for management

action, into a single pool, in readily accessible format. Such an approach tends to reduce the need for and proliferation of single-function management information systems.

CHAPTER III

THE 3-M SYSTEM

Now that a conceptually sound management information system has been developed it is possible to evaluate the effectiveness of the 3-M System. Attention will be focused on the Maintenance Data Collection Sub-system (MDCS) of 3-M since it is the subsystem that has been designed to provide management information.

Maintenance Data Collection

The 3-M System is divided into two broad subsystems. The Planned Maintenance System (PMS) is designed to provide the necessary tools to be used in carrying out scheduled maintenance. The Maintenance Data Collection System, on the other hand, is the medium by which information is gathered from operating units on a timely basis, in a standard format, to assist the manager in answering questions concerning the use of resources and the effectiveness of maintenance performed.[1]

[1] U. S., Department of the Navy, Office of the Chief of Naval Operations, Brochure, Vols. I and II, Navy Maintenance Material Management, Maintenance Data Collection System.

The system is intended to assist various levels of management ranging from the ship level through the material managers.

At the ship level information is to be provided to:[1]

1. Determine effectiveness of preventive and corrective maintenance programs.

2. Identify problems-systems, equipment, or components.

3. Pinpoint weak areas, such as personnel, supervision, schooling, or material.

At the other end of the management spectrum, material managers, information is to be provided to:[2]

1. Improve forecasts of requirements for, and selective distribution of, repair parts.

2. Determine the effectiveness of supply support to the fleet.

3. Evaluate the effect of alterations and configurations on material requirements and material disposal.

4. Improve allowance and load list.

Each maintenance action, either preventive or corrective, is documented (OPNAV FORM 4700.2B) by the persons performing the maintenance. This document is forwarded to the Maintenance Data Collection Center of the ship where it is assigned a Maintenance

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[1] _Ibid._

[2] _Ibid._

Control Number. Supply documents (NavSandA 1250) for issue of material incident to a maintenance action are also forwarded to the collection center where they are accumulated for forwarding along with the maintenance form to the Maintenance Support Office. Figures 5 and 6 are functional flow diagrams of the Shipboard Maintenance Action Form and the supply issue document.[1] Upon completion of the maintenance job, the maintenance data collection document is completed and signed by the workman involved. This document is then screened for completeness and accuracy by the workman's immediate supervisor who forwards it to the data collection center. The document is screened again by the data collection center personnel who then assign it a Maintenance Control Number. The document is forwarded to the Supply Department where information pertaining to repair parts issued, for the particular maintenance action, is entered. The document is returned to the collection center where it is batched with other such documents and periodically forwarded to the Maintenance Support Office (MSO). Whenever repair parts are requested from the Supply Department to support a maintenance action, the supply issue document is prepared by Supply personnel. This alleviates the maintenance man from the burden of preparing supply paper work. After the necessary material has been located and issued from the storeroom the issue document is returned to the supply office. After issue information is posted to the stock

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[1]U. S., Department of the Navy, Office of the Naval Operations, Instruction 4572, Maintenance and Material Management Manual (3-M), pp. 3-5, 3-6. Cited hereafter as 3-M Manual.

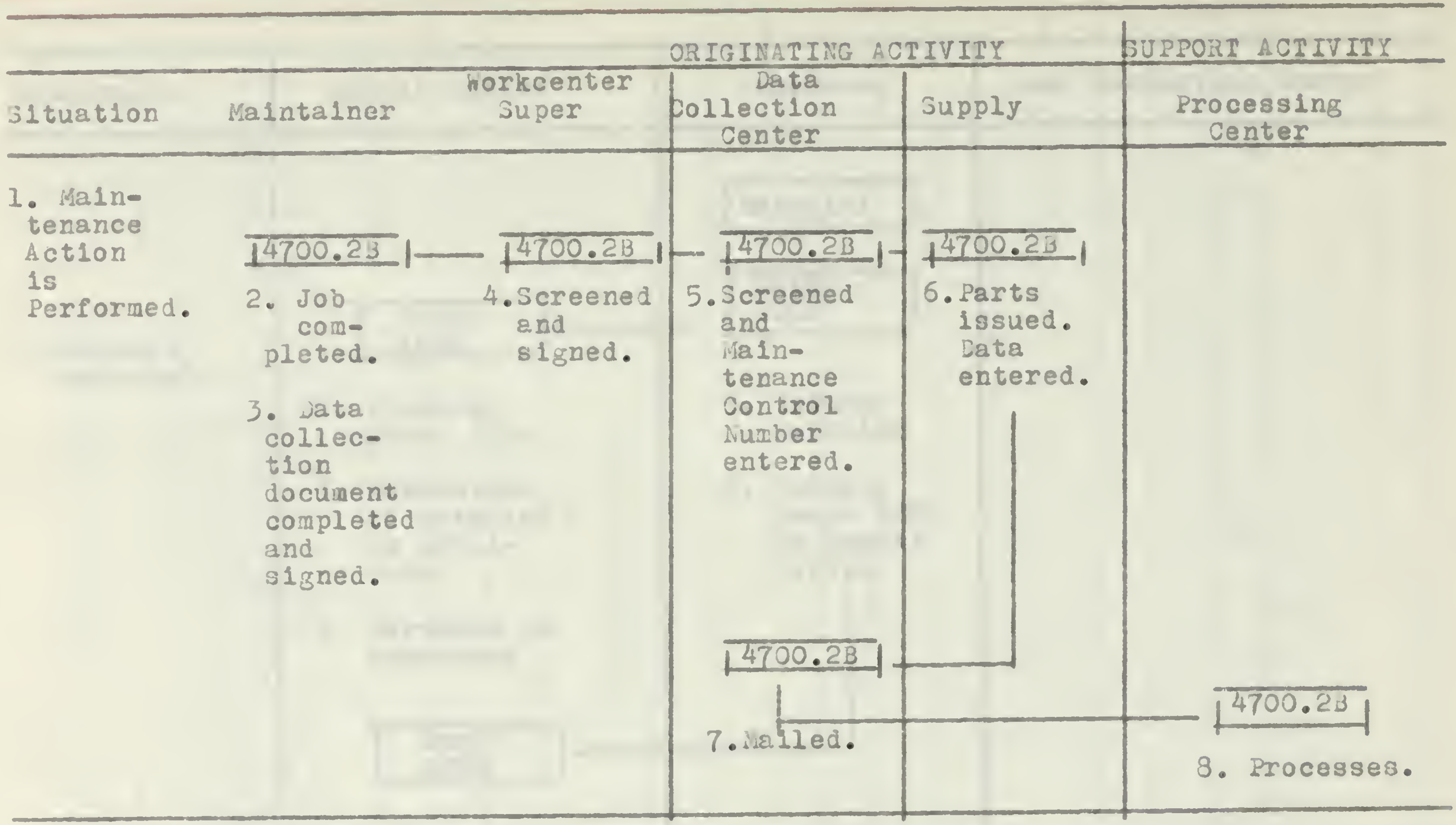


Figure 5.--Functional Flow Diagram of Shipboard Maintenance Action Document OPNAV Form 4700.2B.

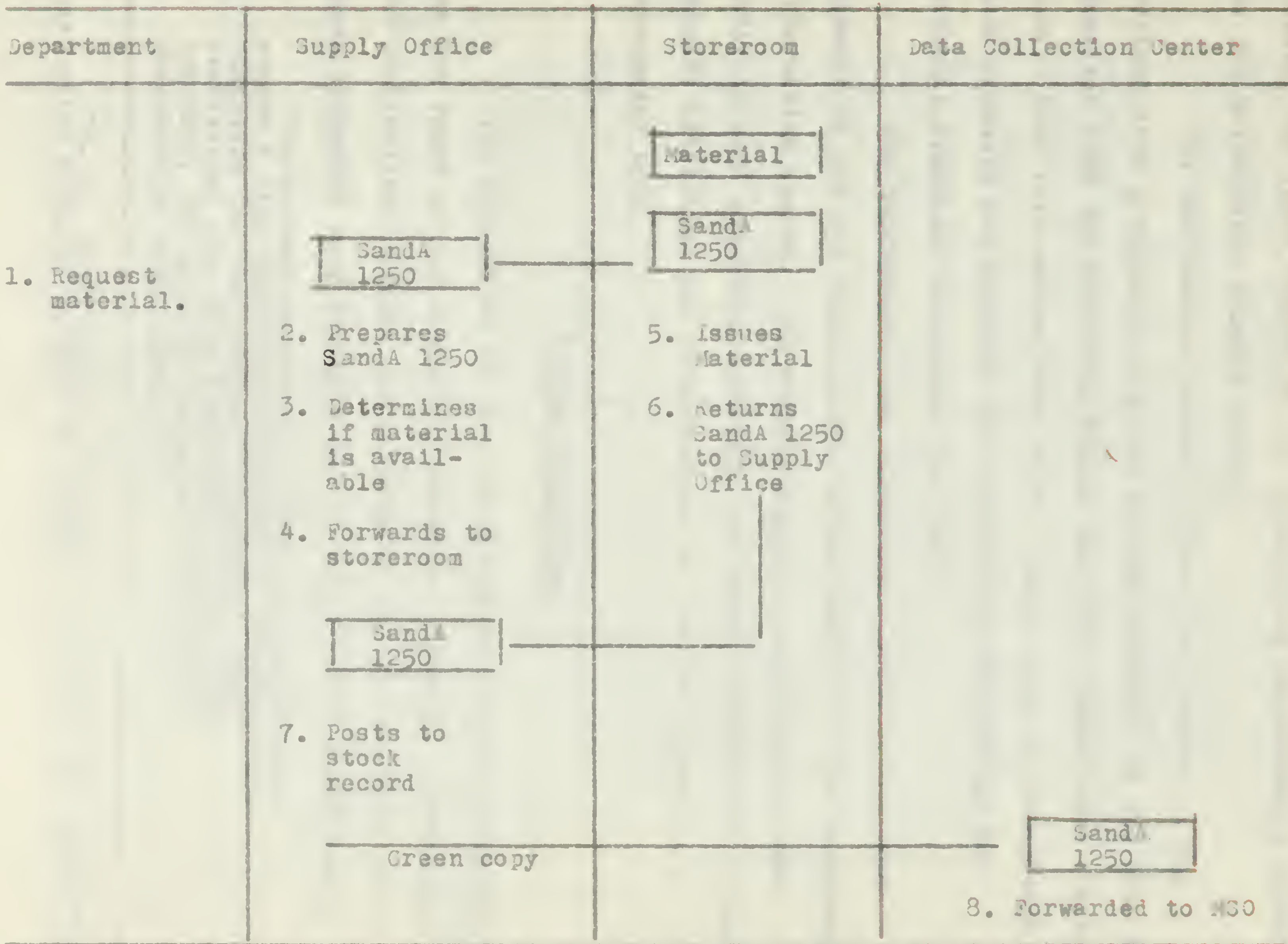
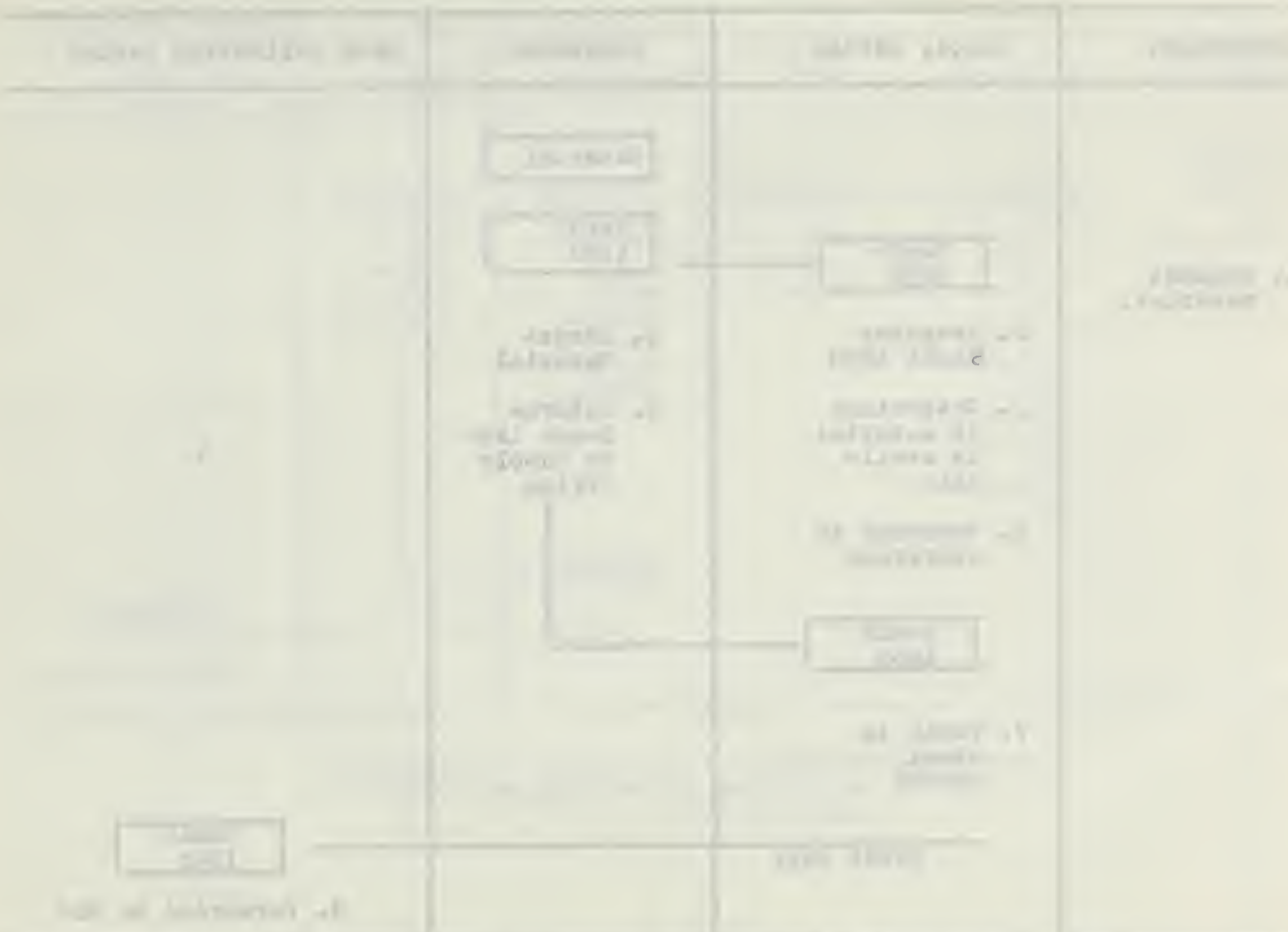


Figure 6.--Issues of Material in Direct Support of Maintenance.



records the issue documents are batched and periodically forwarded to the Maintenance Support Office.

The Maintenance Support Office (MSO) serves as the central data processing facility for the system. As the data are received from the operating forces they are entered into a data bank. From this central data bank a whole array of management data products are prepared for managers of maintenance and material resources throughout the Navy.

The Maintenance Data Collection System is then the element of the 3-M System which is the essence of the management information system. Its effectiveness in providing the user activity with complete, accurate, and timely information in large measure determines the effectiveness of the 3-M System as a management tool.

System Objectives

The objectives of the 3-M System have become obscured in the few years of the system's existence. Numerous instructions and publications address 3-M objectives and for the most part these documents vary considerably in the objectives addressed.

> The primary objective of the 3-M System is to ensure a high degree of readiness by planning and budgeting for the necessary resources. Hard statistical data that identifies the resources required, and supports budgetary requests is essential to this objective.[1]

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[1]U. S., Department of the Navy, Office of the Secretary, Instruction 5430.69, October 21, 1964.

The objective of the 3-M System is to ensure a high degree of readiness by planning and budgeting for the necessary resources. Hard statistical data that identifies the resources required, and supports budgetary request is essential to this objective.[1]

. . . The end objective of the Management System, then is to insure the highest state of aircraft readiness and reliability at the lowest cost in men, money and material. All other considerations are secondary to this objective.[2]

The basic objectives of the 3-M System are threefold: to achieve the highest readiness state of the weapon system, to perform maintenance at the lowest possible organizational level, and to minimize the expenditure of men, money, and material. It is the first of these three objectives that is of primary concern to this survey (although the other two, especially the third is corollary).[3]

The objective of the 3-M System simply stated is to improve material readiness of the Fleet through improved management of maintenance and material functions.[4]

The objective of the 3-M System is threefold: first, to provide management with a tool that can be used to improve material readiness; secondly, to facilitate performance of as much maintenance as possible closest to the scene of action; and third, to reduce the expenditure of men, money, and material to an absolute minimum.[5]

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[1]U. S., Department of the Navy, Office of the Chief of Naval Operations Instruction 4700.16C, 27 August 1965.

[2]U. S., Department of the Navy, Naval Aviation Maintenance and Material Management Manual, 1 August 1965, p. 3.

[3]A. J. Ruffini, "The Standard Navy Maintenance and Material Management System," Naval Ship Systems Technical News, May, 1966.

[4]U. S., Department of Defense, Office of the Secretary, Directorate for Statistical Service, "Measuring Weapons Systems Supply Support and Readiness in the Navy," Stover Report (Washington: GPO, 11 August 1966).

[5]U. S., Department of the Navy, Navy Budget Submission to OSD, November 3, 1966.

The objectives of the 3-M System are twofold:

> 1. Through the use of a Plan Maintenance System, to attain and maintain maximum operational efficiency of all Fleet equipment at all times, reduce down-time of equipments to the minimum consistent with good maintenance practices, and reduce the cost of maintenance in both money and man-hours;
> 2. Through the use of the Maintenance Data Collection System, to provide the means for gathering information as to the expenditure of resources in maintenance of equipments, failure data, and other data directly related to maintenance.[1]

It is not the intent of this paper to question the statements of 3-M objectives contained in the above quoted documents. Each is an accurate statement of the primary or secondary objectives of the system. The above quotations do demonstrate the manner in which the 3-M objectives have become fragmented in official documents and are evidence of a significant problem in the orderly development of 3-M.

Each management level and activity has been free to determine and interpret the objectives of the 3-M System to identify its own interest. The permissive atmosphere and the lack of uniformity in the stated objectives of the system perhaps has led to the misuse or nonuse of the information available. The objectives of the individual manager levels served and the Navy as a whole should be congruent, if the system is to be effective.

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[1] 3-M Manual, p. 1-1.

Organizational and Policy Considerations

A number of evolutionary organizational changes have taken place since June, 1963--the beginning of the 3-M System.

Basic responsibilities for the development and implementation of the 3-M System were assigned to the Chief of Naval Operations, the Commandant of the Marine Corps, and the Chief of Naval Material. Other supporting organizations were directed to "provide full support in implementing 3-M."[1]

The Maintenance Support Office (MSO), Mechanicsburg, Pennsylvania, was established on 1 August 1964 under the command of the Chief of Naval Operations, as the central data processing activity of the 3-M System. In May, 1966, command of MSO was delegated to the Chief of Naval Material with the Naval Supply Systems Command designated to provide primary support.

Under the chairmanship of the Deputy Chief of Naval Operations for Logistics there exists a 3-M System Project Group and a subordinate 3-M Staff Working Group whose combined mission is to ". . . formulate policies and procedures necessary to carry out the intent of the 3-M System."[2]

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[1]U. S., Department of the Navy, Office of the Secretary, Instruction 5430.69, 21 October 1964.

[2]U. S., Department of the Navy, Office of the Chief of Naval Operations, Instruction 5420.48A, 1 March 1967.

In April, 1967 the Chief of Naval Material established an interim 3-M technical Planning Group for the purpose of establishing a 3-M Information System Plan.

The Systems Commands participate--on call--in the activity of the subordinate 3-M Technical Planning Group. These commands have also established focal points within their headquarters for the 3-M System or for the utilization of 3-M data.

The fleet commanders have established 3-M System coordinators and staffs for carrying out their respective responsibilities.

At the CNO/CNM level, which is concerned with policy and requirements, it is customary and necessary to establish policy formulation or coordinating groups under various titles. While this arrangement may be desirable, it apparently does not provide for direct coordination with overall maintenance policy, nor a correlation of maintenance policy with an overall integrated logistic support policy. This suggests that 3-M policy and requirements should be developed in a broader context as a part of an overall Navy maintenance and resource management policy.

A question may be raised regarding the position of the Maintenance Support Office (MSO) which is now commanded by the Chief of Naval Material, while primary support is provided by the Naval Supply Systems Command. MSO's role is envisioned as that

of a central data processing center serving many customers. This role must be precisely defined both to recognize the capabilities and needs of users, and to concentrate more on the development of top quality maintenance data products.

The basic rationale for this is that the 3-M System is predominantly a management tool and the potential users of the 3-M data for management purposes are spread throughout the naval establishment in a number of functional areas spanning the life cycle support of equipment and systems.

Top Navy management has been interested in the development and successful use of the 3-M System from its inception. At every opportunity, the top men in the various organizational components endorse and support the objectives of 3-M on the premise that the employment of sound management techniques will achieve improved fleet material readiness.

In order to communicate the potential value to be gained from the system by the operating manager the Navy has published explanatory borchures and articles in various periodicals.

In 1966, the Office of the Chief of Naval Operations published a brochure[1] in two volumes to present the 3-M System to the Commanding Officers and personnel involved in carrying out scheduled maintenance.

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[1]U. S., Department of the Navy, Office of the Chief of Naval Operations, Navy Maintenance and Material Management, Vols. I and II, 1966.

In an effort to display and emphasize top management's interest and concern in the system, several top ranking admirals included their comments and endorsements. While these endorsements encompassed the entire system, only those directly concerned with the Maintenance Data Collection phase of the system are reproduced here.

> The Maintenance Data Collection System, the second half of the Standard Navy Maintenance and Material Management System, complements and supplements the Planned Maintenance System. It is designed to provide both you, the operators, and the Naval Material Support Establishment with the necessary information to achieve our common goal-improved Fleet readiness. The realization of this goal and the success of the Maintenance Data Collection System is our joint responsibility. On your part, it is the submission of accurate data; on ours, the utilization of that data to provide you with the best maintenance guidelines and equipments possible. As Chief of Naval Material I encourage you in the Fleet to support and use the Maintenance Data Collection System. It demands, and will continue to receive, the most vigorous support of the Naval Material Support Establishment.[1]

> Not so many years ago, shipboard maintenance lessons were shared as gray-haired Engineer Officers of sister ships met over coffee in Log Rooms or Wardrooms, and the expertise of care and feeding the plant endured by dint of long tours of duty. The idea of profiting from hard knocks is as old as man himself, but a more fluid and demanding technology, plus the mobility of our human resources, demand that we systematize the vast mass of experience, so organizing the bits of data as to find the meaningful trends, share the lessons, and progress toward a higher level of effective resource of utilization and Fleet material readiness. This is the meaning of Maintenance Data Collection--a Bureau of Ships-Fleet team effort that has my support, and deserves yours.[2]

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[1] Ibid., p. 13, Vol. II, quoting I. J. Galantin, Admiral, U. S. Navy, Chief of Naval Material.

[2] Ibid., p. 14, Vol. II, quoting W. A. Brockett, Rear Admiral, U. S. Navy, Chief, Bureau of Ships (Present name, Ship's Systems Command).

> All of us in the Bureau of Naval Weapons organization enthusiastically support the development and implementation of the Maintenance Data Collection System. Beneficial effects to the Operating Forces, through use of this system will complement those brought about by the Planned Maintenance System. Both systems have as the common goal the efficient achievement of the highest possible state of material readiness in the Fleet.[1]

> The objective of the Maintenance Data Collection System is to provide all levels of management with data needed to improve maintenance and supply at the operating level. I heartily endorse this objective and the system to attain it. The success of the system rests on the care with which operating personnel feed individual pieces of maintenance data to the collection system. Without their complete support the system will never reach its objective.[2]

All of the above statements attest to top management's support of the system and point out the desirability of operating management and top management goal congruence. However, throughout all of the statements there is an air of permissiveness. Operating managers are enjoined to participate in the system, indicating that the system is voluntary. Any information system that envisions use of the collected data for decision-making purposes must be complete in all respects in order to be effective. As is pointed out later in this paper, the inordinated time span

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[1]*Ibid.*, p. 15, Vol. II, quoting Allen M. Shinn, Rear Admiral, U. S. Navy, Chief, Bureau of Naval Weapons (present name, Ordnance Systems Command).

[2]*Ibid.*, p. 16, Vol. II, quoting H. J. Goldberg, Rear Admiral, SC, U. S. Navy, Chief, Bureau of Supplies and Accounts (present name, Supply Systems Command).

necessary for total implementation and the suspicion that some ships are still not yet reporting is seriously affecting the user's confidence in the data.

Data Elements in the 3-M System

In July, 1963, the Staff Working Group under the sponsorship of the Assistant Chief of Naval Operations for Logistics determined that an initial system consisting of data elements that provide for indication of the reason for the maintenance action, dating of the action, identification of the object of the maintenance action, report on material consumption, report of manhour and action time accounting would satisfy 70.5 percent of the requirements for maintenance and material information.[1] Data collected under the Maintenance Data Collection System are supposedly designed to construct a data file for the development of improved management techniques and decisions.

Figures 7 and 8 illustrate the data elements collected for some aspects of the maintenance Data Collection System.[2]

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[1]Logistics Research Project Technical Memorandum, Serial T-170, A Survey of Information Requirements for Navy Maintenance and Material Management, 15 April 1964.

[2]3-M Manual, pp. 3-1 through 3-4.

Item Number	Description
1	Material source code
2	Unit of issue
3	Cognizance symbol
4	Federal Stock Number
5	CID/APL/AEN/AN*
6	Reference symbol
7	Quantity
8	Unit price
9	Federal supply code for manufactures
10	Part number
11	Fund code

*Component Identification/Allowance Part List/Allowance Equipage List/Army Navy Number.

Figure 7.--Parts Usage

Item Number	Description
1	Administrative organization.
2	Ship account number.
3	Maintenance control number.
4	Date.
5	Equipment identification code.
6	Work center.
7	Assisting work center.
8	Repair activity accounting number.
9	How malfunctioned.
10	When discovered.
11	Action taken.
12	Units.
13	Manhours.
14	Serial numbers.
15	Equipment time.
16	Alteration identification.
17	Type availability.
18	Equipment down time.
19	Service code.

Figure 8.--Ship Maintenance Data

Data can be separated into two categories: (1) static data and (2) dynamic data. Static data may be defined as that data which are used mainly for reference and are updated in widely separated time frames independent of normal computer runs. Dynamic data include all data which are intended to be updated and which are either input to the system or output by the system.

Data requirements for the 3-M System fall in the following categories:

1. Dynamic/Static Data.
   a. Ship Maintenance Data.
   b. Parts Usage Data.
   c. Aviation Maintenance and Statistical Data.
   d. Shipyard Data.
2. Static Data.
   a. Ancillary (non MDCS) Data.

Although 3-M data are subjected to various data validation programs, which will be discussed later, the quality of the more subjective data elements depends on the motivation of those who complete the various reporting forms. This motivation depends on the obvious advantages derived from providing quality reporting. One potential advantage would be the use of the data that provide some visible, direct benefit to the supplier of data.

Some of the data elements identified previously present specific difficulty to the orderly and accurate reporting of

maintenance action. The Action Taken Codes are limited in appropriate application or have varied implications. The maintenance personnel must decide from the codes available how best to describe the action taken.

The data element also presents a margin of confusion since the dates reported differ for the maintenance action, parts issue, deferral and work request documentation. These differences in dates do not facilitate the definition of a rigid document control system for Automatic Data Processing operations.

The most significant element is the Equipment Identification Code (EIC). These codes are provided in a manual issued by the Maintenance Support Office. The Equipment Identification Code is a basic coding structure established in the shipboard side of the 3-M System which identifies the smallest desired breakdown of an equipment or unit and the system sub-system which serves it. The code is a basic identifier to which maintenance and material actions are related.

EIC's are assigned to identify the lowest desired breakdown of an equipment; for example, system, subsystem, equipment, subassembly, part/circuit. This is done by requesting the engineering organization cognizant of the particular equipment to recommend the depth of the desired breakdown. These recommendations often result in the assignment of codes to the subassembly level, the part level or both--this being the

engineer's choice at the time. Several problems arise in connection with the use of Maintenance Data Collection information due to problems associated with EIC's. Use of the information in Allowance and Load List Program will be discussed later in this paper.

There is a lack of common reference points between Maintenance Data Collection System documents relative to a singly completed maintenance action. The Maintenance Control Number may recycle frequently and be reassigned to the EIC when issued in blocks to the work centers. Control of the documentation is dependent on a combination of the Unit Identification Code, The Maintenance Control Number, the Action Completion Date and the Equipment Identification Code. This precludes definition of a complete maintenance action for Automatic Data Processing control. Centralized assignment of maintenance numbers[1] makes it difficult to assign a single number to a maintenance action without it being inadvertently utilized by another department. Under the present procedures, documentation of maintenance actions requires a minimum of two separate documents bearing identical Maintenance Control numbers.[2] In some instances, such as a case that needs outside assistance, more than two separate documents are required.

[1] 3-M Manual, p. 3-3.

[2] Ibid.

Depending on how much knowledge a particular maintenance man has in the intricacies of the system, the situation can develop into a tangled maze of confusion. The recorded unit's indicating the number of equipments/components subjected to maintenance requirement or action is of questionable validity. The degree of maintenance each unit is subjected to in multiple unit maintenance requests is not clearly indicated. For example, if five identical equipments have been worked on: two units received minor or little maintenance effort (resources) to restore to specification; and three units received maximum maintenance effort (resources) to restore to specification. The reported information does not reflect the various degrees of resources expended. The accountability of serialized controlled equipage is difficult to establish when more than one unit is documented on a maintenance action form. Individual equipment data are lost with regard to the history of that equipment. For serialized equipments, the present requirement is to document individual equipment separately regardless of identicality of EIC and maintenance action taken. This imposes extra burden on the maintenance man to repeat all data elements on an individual maintenance data form except the serial number block. It is not impossible to do away with this problem of repetitive tasks but procedures have not been provided yet to alleviate this burdensome task of the maintenance man.

The reporting of Manhours, Units, and Active Maintenance Time on the present maintenance data form is restricted by the following limitations:

a. Manhours---------------0-999.9

b. Units-----------------0-99

c. Active Maintenance Time----------------0-99.9

Whenever the above limits are exceeded an additional document or documents are required to record the overflow.

The task of building a cross-reference capability into a computer system for parts usage data is probably preferable to the alternative of requiring that voluminous nomenclature information be supplied by the maintenance personnel. For example, the Unit of Issue, Unit Price, and Cognizance Symbol could be obtained from such a file.

Not all organizations have access to a pricing tool. In most applications, this data element on the maintenance action form is ignored and the Fleet Oriented Consolidated Stock List file is used for automatic pricing.

Data which are not formatted cannot be utilized as a parameter for retrieval or output, as may the data content of formatted data. Obviously, the application of the 3-M System as the source of data that can be processed by automatic means is dependent on accurate source data.

The maintenance action data generated in shipyards are not presently being collected under the Maintenance Data Collection System but are planned for the future as a milestone in the orderly implementation of specific tasks.[1] When the 3-M System is eventually extended to the shipyards it will provide for the collection of data concerning which equipment required maintenance action at the depot level, the initial discovery of the malfunction, how the equipment malfunctioned, the maintenance actions performed, and how many manhours were expended to perform each maintenance action.

Validation Specifications in the System

In order to produce high quality, accurate, and meaningful reports, the validity of data used in their preparation must be established.

The function of the validation is to determine the admissibility of data collected for use by the system.

The validation tests are based upon specifications devised in the field by the Fleet Work Study Group, Atlantic, and are distributed to operational and 3-M Data Processing support commands by the Maintenance Support Office, for quality reporting control purposes.

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[1] U. S., Department of the Navy, Office of the Chief of Naval Operations Instruction 4700.16, August 27, 1965.

MSO edits all input data to determine errors in certain selected fields in accordance with predetermined criteria and produces a Detailed Error Listing of these inconsistencies.

Sixteen of the twenty-six data fields on each parameter card are edited for validity. In these fields there may be errors that cannot be detected by the established criteria. As an example, a unit price of one dollar may be reported as one hundred dollars. Errors of this type and errors in the unedited fields are included in the Master Data Files.

Fatal errors--those that would tend to contaminate, or invalidate, an entire file--are not added to the file. Figure 9 gives a list of errors considered to be fatal.

Field Title	Criteria
Ships Account Number	Data not useful for report preparation because it cannot be related to a particular ship.
Maintenance Control Number	Data cannot be filed in the master file with the balance of its maintenance action or related to a specific maintenance action.
Equipment Identification Code	Data cannot be related to a particular equipment.
Card Code	Valid code required by the computer for field identification.
CID/APL/ASL/AN	Valid data required to associate the item to a particular equipment or component.

Figure 9.--Fatal Errors[a]

[a]Logistics Research Project Technical Memorandum, Serial T-170, A Survey of Information Requirements for Navy Maintenance and Material Management, 15 April 1964.

According to MSO's quarterly report of Maintenance Data Collection System (MDCS) errors for the first quarter of fiscal year 1967, of the 849,693 card images edited one or more fatal errors were found on 5.9 percent of the images. This compares to 187,729 card images and 7.8 percent fatal errors for the preceding quarter.

Card images containing non-fatal errors are included in the Master Data File, however, and during this quarter 1.3 percent of the card images included in the file contained at least one non-fatal error.

Figure 10 shows the breakdown of the validity of data input for the first quarter of fiscal year 1967.[1]

Completeness of data is an important element of a conceptually sound management information system. Based on a recent test of completeness of the data contained in MSO Master Data File it was found that thirty-seven percent of the maintenance actions requiring parts do not have their associated parts linked with the maintenance. In addition, the sample studied indicated the data bank contains more non-valid than valid parts data.[2]

In order for the data collected to be of value to the users, all information associated with a single maintenance action

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[1] MDCS Error Analysis Quarterly Report, Report #124-2, December, 1966, p. 5.

[2] Maintenance Support Office Technical Report 3054-409067, 13 September 1967.

Month	Raw Data	Error Data[1]	Fatal Data[2]	Total number of errors	Valid Data	Percent Valid[4]
July	198,710	12,221	10,135	14,268	188,575	94.89
Aug.	287,900	25,342	18,993	34,182	268,907	93.48
Sept.	363,085	23,314	20,775	29,961	342,358	94.24
Total	849,695	60,377	49,853	78,411	799,840	94.13

[1]Error data include fatal and non-fatal data. Non-fatal data in Master file = 11,724 (Error data-Fatal data).

[2]The number of cards left out of the Master File.

[3]The number of cards updating the Master File.

[4]Valid data divided by raw data.

[5]Percent of raw data without errors = 92.8 $\left(\frac{\text{Raw data-error data}}{\text{raw data}}\right)$.

[6]Ratio of error data to total errors = 60,877:78,411 = 1:1.29.

Figure 10.--Validity of Data Input

must be tied together. The tying together of the data input cards yields a picture of what has taken place--it tells the story. This association of cards is accomplished by data processing equipment. If this union cannot be effected in every case, then some of the cards, representing events generated by the action, will be lost. It will be difficult, if not impossible, to recreate this action within the data processing equipment or on paper under these circumstances.

There are a number of problems connected with the association of all elements of a maintenance action. In general, when data cards cannot be correctly tied together, it is the result of documentation errors, key punching errors or non-standard procedures.

The problem here appears to be that the data collection system gathers data at the working level, i.e., the maintenance man doing the work documents his own actions. However, parts used with such actions are not documented on 3-M form; documentation is generated by reproducing, in part, supply documents. There has been some discussion in the 3-M environment about the use of supply documentations, but it has been centered primarily around the difference between "usage" and "demand." The supply system reacts to demand and yields the number of parts issued rather than the number used. This will introduce errors into the system; however, it is hypothesized in this paper that the primary source of errors is a result of the physical separation of source

documents prior to being committed to machine reader language. This greatly increases the probability of error in like data fields, and also permits reporting only part of the actions.

Planned Maintenance System Reporting by Ships

The Maintenance Data Collection System provides a document on which maintenance personnel record, at the source, one time, and one time only, designed information concerning planned or corrective maintenance actions required or accomplished.

The total possible number of data elements to be entered on the maintenance action form is twenty. When a planned maintenance action cannot be accomplished due to ships operations, lack of material, or the requirement of outside assistance, additional documentation is required. Additionally, spare parts used during the maintenance cycle are recorded on the reverse side of the action form, when such parts are procured from outside normal supply channels or from pre-expended bins. When parts are procured from normal supply channels, usage is recorded on the supply issue document.[1]

The requirements to report all maintenance actions, planned and corrective, result in significant workload on the operating forces. During the month of April, 1967, a total of

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[1] 3-M Manual, Chapter 3.

300,964 maintenance action forms were received by the Maintenance Support Office. Of this quantity, 50% were related to planned maintenance actions.

In a recent audit the Navy Area Audit Office, Philadelphia, Pennsylvania, estimated the number of maintenance action documents is expected to increase eventually to about one hundred million annually. Of this quantity, approximately sixteen million will relate to shipboard maintenance.[1] Therefore, if the current ratio of preventive to corrective maintenance continues, approximately eight million reported actions per year will result from planned preventive maintenance.

Maintenance Support Office studies indicate that there is a high level of "gun decking" (falsifying records) in planned maintenance reporting. A review of 2,278 required actions indicated:

887 accomplished and reported

445 accomplished and not reported

518 not accomplished

428 not accomplished and not reported.

This represents approximately 37% "gun decking."

The reasons for "gun decking" are many and varied but the basic motivation is probably implicit in the stated requirement

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[1] Naval Area Audit Report No. A20677, Maintenance Support Office, Mechanicsburg, Pennsylvania, January, 1967.

for Planned Maintenance Reporting. "It is required by type commanders and squadron commanders for policing actions."[1]

The present requirement for reporting reflects the expenditure of many man hours at the shipboard level that could be more effectively utilized in the performance of maintenance.

Exception reporting could eliminate the majority of the reporting workload from the ships. A disadvantage of exception reporting is that it introduces the human element of implying that individuals are to "put themselves on report." This is not any different, however, from the present system whereby individual ships that do not report Planned Maintenance Actions are automatically "on-report."

<u>Timeliness of Data Input</u>

MSO as well as other Navy organizations have been interested in timeliness of data since the inception of the 3-M System. Several studies have been conducted which display the cards received in relation to their action dates.

For any particular action month, the data have the following cumulative arrival percentage: (Figure 11) during the action month, 5 percent; one month later, 50 percent; two months later, 80 percent; three months later, 90 percent; four months later, 95 percent; and five months later, 97-98 percent. In

[1] <u>3-M Manual</u>, p. 2-1.

CONSOLIDATED SHIP STUDY 1 (APRIL 1965-JULY 1966)

Month Rec'd	Apr 1965	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan 1966	Feb	Mar	Apr	May	Jun	Jul
Apr	5															
May	48	1														
Jun	82	61	11													
Jul	90	83	54	2												
Aug	96	93	84	47	3											
Sep	97	96	92	77	54	6										
Oct	98	97	94	85	72	43	5									
Nov	99	98	97	91	86	77	51	5								
Dec	99	99	98	95	93	90	81	55	6							
Jan	100	99	99	97	95	93	90	79	52	7						
Feb	100	100	99	98	97	96	94	89	79	43	2					
Mar	100	100	99	99	98	98	97	96	91	82	55	7				
Apr	100	100	100	99	99	99	99	98	96	93	85	58	5			
May	100	100	100	100	100	100	99	99	98	97	94	86	58	9		
Jun	100	100	100	100	100	100	100	100	99	99	98	96	88	64	15	
Jul	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Figure 11.--Cumulative Percentage of Cards Received by Month

order for 100 percent of a month's data to arrive at MSO, it takes at least nine full months after the action month.[1]

Figure 11 shows the cumulative percentage of cards received with particular action dates by months during the period covered. Therefore, the cards received and validated by 31 July 1966 were considered 100 percent of the cards that would be received for each specified action date. The cumulative percentage of cards for each previous monthly period is calculated based on this as the 100 percent figure.[2]

The Type Commander Reports are processed forty-five days after the end of the quarter to be covered in the report.[3] With this schedule, the quarterly report should include all data received on the last day of the month following the quarter ending date. For example, the Type Commander report covering April, May, and June will include all data received at MSO through 31 July. A check of the first quarterly data shows that when the report is produced, only 90% of the April data will be included, 83% of the May data, and 54% of the June data, for an overall inclusion percentage of 73. Data which do not appear on the report due to lateness never appear on any subsequent Type Commander Report. With the present cycle, 30% of all action is

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[1] Maintenance Support Office, Technical Report #2029-120126 (S), 5 May 1967.

[2] *Ibid.*

[3] U. S., Department of the Navy, Office of the Chief of Naval Operations, OPNAV Instruction 4700.20, November, 1965.

never displayed. Based on its use, the report should be representative of a quarter's worth of actions. Therefore, the need for the exclusion of "late" data is questionable. Since the data are not available in-total, for approximately nine months, there are only two possible solutions--either wait nine months, or include the data missed in the next report. A report that included other actions as received and did not present a particular quarter's actions only would not be a "carbon copy" of the quarter in question, but in the long run would be representative of a quarter's worth of actions. Such a report should be a more accurate and valuable tool than the present incomplete report.

Interface Problems

The scope of the 3-M System and the very nature of the program--which extends into numerous organizations and programs of the Navy--require that it be compatible with operations within the Navy. The 3-M System is the Navy's first attempt to design and implement a system which provides supply and maintenance data requirements to functions that are separately managed in the Navy. This feature and the fact that 3-M is imposed on an environment of "on-going systems" have given rise to some of the interface problems that exist.

The major area of conflict appears to be at the depot maintenance level where fleet and type commanders are establishing

procedures to collect maintenance data costs. The Industrial Maintenance Prediction Accounting (IMPACT) Program,[1] a module of the Resources Management System, at the shipyard level; Uniform Automatic Data Processing System for Naval Air Rework Facilities; and the Navy Ordnance Management Information System are examples of systems whose maintenance data are excluded from MSO's data bank.

The Uniform Automatic Data Processing System for Inventory Control Points (UADPS/ICP) (Ship's Parts Control Center segment), Ship Casualty Reporting System (CasRept), Conventional Ammunition Information Management System (Claims), and the Serialized Missile Accounting Control System (SMACS) are systems that are operating or will be operating from data bases located at the Ships Parts Control Center, Mechanicsburg, Pennsylvania. Since these systems will be supported by many of the same data elements (federal stock number, part numbers, equipment identification codes) that are contained in the 3-M data bank at MSO, it would indicate that with close coordination, analyses, design and programming effort could be optimized and the development of files structures and data processing be kept to a minimum.

Currently, under the 3-M System, maintenance actions performed at (1) the organizational level (ship and aircraft squadron) and (2) the intermediate level (tender/repair ships and

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[1] U. S., Department of Defense Directive 7000.1, Resource Management Systems of the Department of Defense, August 22, 1966.

repair activities ashore) are being collected. However, a major segment of the maintenance work performed in or for the Navy is not being reported in the 3-M System. Until this void is filled, the data being collected represent only a part of the total maintenance performed and, therefore, are incomplete and of questionable use and value to the user.

In the early development of the 3-M System milestones were established for the orderly implementation of specific tasks.[1] One of these tasks established a plan for the reporting under the 3-M System of maintenance work performed at the depot level--Naval Shipyards, Naval Ordnance Stations and Naval Air Rework Facilities. Although the plan lacked detail, a stated objective was to include the depot level into the Maintenance Data Collection phase of the 3-M System. To date this has not been accomplished.

The existence of on-going information systems of primary interest to the organizations mentioned above undoubtedly has caused a lack of enthusiasm on the part of these organizations to embrace the 3-M System. Integration of the existing information systems and the 3-M System requires a clear understanding of the concepts, objectives and requirements of all systems involved.

In addition to depot level maintenance work performed in Naval Shipyards a considerable amount of such maintenance is

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[1]OPNAV Instruction 4700.15A, August 27, 1965, Enclosure (1) Program Milestone Plan for Implementation of the 3-M System.

performed in private commercial yards. Accounting, production and planning systems, much of which are consolidated in shipyard management information systems require naval shipyards to report when and how they spend the funds given them, and the expenditure accounting by job order is unquestionably accurate. Much of this stems from the Naval Comptroller and General Accounting Office requirements to audit the use of public funds. On the other hand, detailed costs of labor and material used on ships being repaired or overhauled at private shipyards are not required to be submitted. The individual work items are specified in a package (the low cost bidder on the total package gets the job) and return costs by individual work items are not required. In fact, it is suspected that reporting actual costs would be repelled by private shipyards as it exposes their costs of doing business to competitors and thereby destroys fundamental principles of competition.

In order to collect repair and overhaul data in private shipyards, the depot level reporting through the Maintenance Data Collection System would have to be based on estimates made by the planning personnel on the staffs of Supervisors of Shipbuilding, Conversion and Repair, who are the contracting officers and managers of work on naval ships in private shipyards. Thus, a dilemma exists where costs of work items done in private shipyards do not reflect actual costs, but estimates, whereas work in naval shipyards does represent actual expenditures.

CHAPTER IV

USES OF 3-M DATA

General

As a further attempt to evaluate the effectiveness of the 3-M System, it is necessary to examine the value of the information generated, from the viewpoint of the user. Engrained in the objectives of the System from its inception was the intention of gathering usage data on the material used in maintenance actions so as to provide a better base of repair parts in the operating fleet.

The 3-M System Manual[1] prescribes that usage data be recorded by maintenance and supply personnel and processed by the system. Usage data thus acquired are intended to provide current intelligence and actual usage history related to specific equipments. The Navy Supply System is presently using 3-M System data to develop and improve its Allowance List Program. ✓

Allowance List Program

In order to appreciate the significance of the use of the 3-M System data in the Allowance List Program it is necessary to

[1] *3-M Manual*, p. 3-1.

first develop an understanding of the program itself. Further, it is necessary to understand the methods and procedures employed by the Navy Supply System for the utilization of 3-M data.

The purpose of the Allowance List Program is to establish the shipboard material support for installed and portable equipment and to provide a listing of the equipage required for a ship to perform its operational mission. The Coordinated Shipboard Allowance List includes all the equipments or components installed for the ship to perform its operational assignment; the repair parts and tools required for the repair of the equipments, and the items required for the care and upkeep of the ship.

In order to improve constantly the quality of the allowance list a program entitled the Fleet Logistics Support Improvement Program[1] was initiated which provides for the continuous rewrite and updating of the allowance list.

The criterion established to define what should be in the allowance list is that it should include only items vital to the support of the primary mission of the ship or the safety and welfare of the crew.

The following basic constraints establish the parameters for the allowance list:

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[1] U. S., Department of the Navy, Naval Supply Systems Command Instruction 4441.19, Procedures for Utilization of Navy Maintenance and Material Management (3-M) and Casualty Reporting (CASREPT) System Data for Improvement of Coordinated Shipboard Allowance Lists (COSALS), June 8, 1967.

1. The ship must possess the capability to install the provided repair parts considering the availability of trained personnel, special tools, facilities, and maintenance instructions.

2. Demand based items, which have a predicted usage of at least one in ninety days, are included.

3. Insurance items, such as pump impellers, armatures, and transformers are provided on a minimum quantity basis--that is, either one or the minimum replacement unit.

In June of 1967 the Navy Supply Systems Command established a three phased program for the utilization of the 3-M System data for the improvement of coordinated shipboard Allowance Lists.[1] This program prescribed the procedures of the application of 3-M System data, along with usage data gathered from other sources, in the revisions of Allowance Parts Lists within the parameters of the Fleet Logistics Support Improvement Program.

The three phases of the program required:

1. An analysis of repetitively used repair parts which were carried in the allowance list.

2. The development of new "best replacement factors" based on reported 3-M usage data.

3. The development of "application replacement factors" based on 3-M usage data.

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[1] Ibid.

The program directed the Fleet Material Support Office and the Navy Inventory Control Points (Electronic Supply, Great Lakes, Illinois and the Ship's Parts Control Center, Mechanicsburg, Pennsylvania) to process 3-M data for allowance list.[1]

On a quarterly basis the Fleet Material Support Office receives from the Maintenance Supply Office a tape of the latest twenty-four months' 3-M System generated usage data covering all items assigned the following source code:

"C"--Material not authorized for on board stocking by the allowance list but stocked on board because of demand usage and issued from storeroom stock when requested.

"F"--Material not authorized for on board stocking by allowance lists but stocked on board because of demand/usage and was not in stock when requested.

"G"--Material not carried which was requisitioned or purchased when requested. Not carried items are those not authorized for on board stocking in any quantity by the allowance lists and also not stocked on board because of demand/usage.

This tape includes both the federal stock numbered and manufacturer's part numbered items. The following data are provided on each item:

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[1] *Ibid.*, Enclosures (1) through (4).

1. Source Code.
2. Type of Availability.
3. Federal Stock Number or Part Number.
4. Special Management Identification Code.
5. Allowance Parts List Number.
6. Equipment Identification Code.
7. Nomenclature.
8. Unit of Issue.
9. Quantity required.
10. Ship's Unit Identification Code.
11. Ship's Class and Hull Number.
12. Date of Input (day-month-year).
13. Unit price.

For all items having a demand frequency of three or greater, the following lists reflecting all of the above data are prepared:

1. Federal Stock/Part Number sequence and Allowance Parts within.

2. Allowance Parts List sequence and Federal Stock/Part Number within.

3. Federal Stock/Part Number sequence for those items which do not have an Allowance Parts List.

These listings, along with similar data extracted from other reporting systems, are then forwarded to the appropriate Inventory Control Points.[1]

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[1] *Ibid.*, pp. 1-2.

Subsequent to the initial listing, a record is maintained of those items with quantities summarized by quarter and is submitted to the Inventory Control Points for review over a two year period. Quarterly demands by Federal Stock Numbers are compared with this history file, and only those items which have not been shown on previous listings are forwarded.

Upon receipt of the above listings the Inventory Control Points identify each Allowance Parts List to its approved maintenance plan and compare each item to determine if it has been designated as a maintenance candidate for the appropriate ship type. The part number items are identified to established Federal Stock Numbers. Where the maintenance capability listed on the approved plan coincides with the level reported by the ship, system stocks are reviewed to insure that support of the item is in accordance with the reflected demand.

Intern Allowance Parts Lists are prepared and distributed to the applicable ships for updating of the ship's material support.

The program for utilizing the 3-M System usage data is relatively new; however, several studies have been conducted for the purpose of evaluating its effectiveness.

During the month of September, 1967, the Fleet Material Support Office conducted a comparison and evaluation study on the three data collections systems providing demand/usage data for the

computation of replacement factors.[1] The three systems considered were:

1. The 3-M System.
2. The Supply Operations Assistance Program.
3. The Inventory Control Point Collection System.

The results of this study as they pertain to the 3-M System indicated the following significant facts.

The first Navy ships started reporting under the 3-M System in January, 1965, with other ships phasing into the system over varying time periods. The last Type Command Ships (Air Force, Pacific) entered into the system in May, 1966. These dates mentioned above cover the time period during which nearly all ships under a given Type Command entered the 3-M reporting system. Reporting as of the study was still in the areas of service forces, carriers, and amphibious units, especially in the Pacific.

As of the date of the study the Maintenance Support Office was conducting a study, on an activity basis, to determine what activities were not on the 3-M reporting system and why they were not. This study is unquestionably necessary to insure completeness of reporting but it is interesting to note that it is being conducted by the organization designated as the central data processing activity. The Maintenance Support Office is an

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[1] U. S., Department of the Navy, Navy Fleet Material Support Office, Letter 9712198 4000, September 21, 1967.

information processing service center and is not a command responsible for the completeness of reporting.

The lack of timeliness in complete reporting is apparent in comparing two sets of usage data extracted for the Cruiser-Destroyer Force Atlantic destroyers. The first set of data covering the time period from January, 1965 through December, 1965, contained 108,570 action reports. The second set of data, covering the time period from September, 1965 through August, 1966, contained 238,075 action reports.[1]

The study provides some insight into the validity of the data that are received. Maintenance action reports received from destroyers of both the Atlantic and Pacific Forces for the calendar year revealed the following:

Type Action	Atlantic Destroyers	Pacific Destroyers
Valid maintenance action with parts	118,551	80,193
Invalid action with parts	40,462	26,681
Parts without action	80,700	71,080
Valid action without parts	663,590	479,061
Invalid action without parts	57,270	57,267

[1] Ibid., p. 4-5.

Problems

The Navy Supply System is continuing to conduct research and development for future programs, for example, development of usage rates, provisioning criteria, and inventory management programs. However, certain weaknesses in the 3-M System tend to lessen the confidence in usage data as reported.

There are multiple ways to identify material--for example, manufacturer's part number, Federal Stock Number, Equipment Identification Code and the Component Identification Code. The most commonly used is the Federal Stock Number or the part number. The main problem in this regard is to have the data originator and/or key punch operator transcribe the alpha-numerical material identifier into the system. As illustrated previously, there is little by way of data validation once the data are forwarded to the Maintenance Support Office. When a manufacturer's part number is used to record usage data, it is difficult to read it mechanically because there are so many possible formats for a single part number.

Usage data are often recorded against a major end item rather than against a specific sub-assembly. The assignment of an Equipment Identification Code to the sub-assembly of an equipment is conceivably as low in the breakdown structure that is necessary. One of the fundamental concepts of the 3-M System is to relate maintenance actions and material usage to specific equipment applications. The Equipment Identification Code cannot be tied effectively to material coding systems such as the

Component Identification Code which is the basis for the repair part allowance lists. The equipment codes in their present form are maintenance oriented and developed independently of present cataloging systems. People having special technical experience in the three areas of (1) Hull, Mechanical, and Electrical; (2) Electronics; and (3) Ordnance, make the breakdown determinations independently. Because of the recognition by specialists of their particular problems, they reflect desires for information by varied code structures. Therefore, levels of indenture vary widely both within and between equipment categories. For example, four to six levels can be cited in the current structuring[1] and levels of assignment are not controlled. Some codes go down to piece/part and others do not. Also, parent and subordinate entries are at the same level of indenture. Primarily, the code is a functional identifier which tells where the component is used. However, in some equipment areas, the assigned code is more than functional and establishes the exact identity of a component or tells what it is. Codes assigned to the Hull, Mechanical and Electrical area are purely functional and do not identify a unique component by manufacturer, model or other characteristics. On the other hand, codes assigned to Ordnance are functional and generally related to unique components.

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[1] 3-M Manual.

Inherent in the Equipment Identification Code is the lack of consistency. Because of this feature, a simple conversion cannot generally be made from the code to the current material codes in the Navy. For example, no one-for-one relationship currently exists between the Equipment Identification Code and the Component Identification Code and the former does not relate to service application. Without this cross-reference capability, the user is not able to identify the unique component by manufactures, model, or characteristic. As a result of this inability to identify a maintenance action to the specific component involved through the Equipment Identification Code alone, only limited use can be made of the data collected, with regard to allowance list improvement, and even this is realized only through extensive manual effort on the part of the user.

The 3-M Procedures Manual[1] does not provide for a uniform method of reporting material obtained from other than normal supply sources, such as pre-expended, cannibalized, or salvage material. For example, pre-expended material is reported except for "screws, nuts, cotter pins and solder, etc." The term "etc." is confusing and subjected to varied interpretations. The pre-expended concept presupposes elimination of record keeping and reporting. The 3-M System provides for record keeping and reporting to satisfy the requirements of technical analysis, maintenance costing and supply management.

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[1] _Ibid_., p. 3-4.

There are several instances inherent in shipboard supply procedures where internal 3-M issue documents do not result from issue of material and, therefore, usage is reported to the system; for example, material requisitioned for direct turnover to the requestees. This material is not entered on the supply stock records and an internal issue is not prepared. Receipt by the requestor is obtained on the receipt invoice. Purchases in the open market are turned over to the requestor on the vendor invoice, thus an issue document is not generated.

Currently there are not procedures which recognize or provide for the unit of issue versus the unit of use. At the organizational and intermediate levels, maintenance personnel record the unit of issue on the maintenance action document. Although technical research is required for this information and although any resemblance between unit of issue and unit of use may be coincidental, personnel are not instructed how to dispose of material charged to a Job Control Number but which is in excess of his needs because of unit pack considerations.

There is no way to capture usage data for material consumed on tender/repair ships, having a mechanized data processing capability where the usage is recorded against its own Unit Identification Code. Procedures provide that pertinent supply data be entered in the maintenance action form where organizational maintenance is performed by itself, for itself, on a tender/repair ship. However, when the document flows through

the key puncher, there is no program to produce a complete usage card to include component Identification Code and Allowance Parts List information. The system does provide for such information for tended ships.[1]

In spite of the aforementioned problems with the accuracy and completeness of 3-M System usage data, the Navy Supply System is finding this information useful. Subject to certain procedural tightening of the system, the potential value of the 3-M usage data is recognized for the development and refinement of Coordinated Shipboard Allowance List.

The Navy Supply Systems Command reports that as of July, 1967, a total of 492,269 3-M parts usage cards were analyzed. Of this total there were 62,444 parts used that were not carried in shipboard allowance lists. The allowance list effectiveness based on this data was 87.4%.[2]

Before the full potential of usage data can be realized, however, holes in the system must be plugged so that confidence is established in the quality, scope and validity of the data.

Current use of 3-M usage data tends toward correlation to, and improvement of, allowance lists. So long as current

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[1]Ibid., p. 4-1.

[2]Navy Supply Systems Command briefing, Coordinated Shipboard Allowance List Program (unpublished).

conditions prevail, replenishment decisions will necessarily be based on demand with little reference to reported 3-M usage data. That is, the Supply System is now committed to replenish what is demanded out of the system, regardless of whether the Maintenance Data Collection System document is properly recorded and reported signifying usage of the material bought. However, as usage reporting is improved, comparison of reported demand and reported usage by customers becomes more meaningful. Intelligence of this nature should be a basis for local management to police recorded demand expenditures against what he reports as material use.

Configuration Management

The Maintenance Data Collection System, as defined in OPNAV Instruction 4700.16C, is a system for collecting, processing and analyzing maintenance and material data and distributing information products derived therefrom to enable line commanders and material bureaus to carry out functions in support of operating forces.[1]

The Navy Configuration Management Program, as described in Navy Material Instruction 5000.6 of 1 February 1966, is to constitute the basis for developing and implementing a system for effective total configuration data file for the use of the

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[1] U. S., Department of the Navy, Office of the Chief of Naval Operations Instruction 4700.16C, 27 August 1965.

Standard Navy Maintenance and Material Management System.[1]

Upon review of these directives it is apparent that a vehicle for certain configuration information reposing in the 3-M System could be conceived as that in the Maintenance Data Collection System through its reporting documents. Under this reporting system it must be noted that the nature of the configuration information that can be reported is in generical title down to the lowest designated assembly by the major systems comprising the ship. Nowhere does this kind of configuration information directly relate to the identity of the system, subsystem, component or part to the total extent necessary to carry out technical analysis or support total configuration management. But it does provide a configuration structure breakdown which can be easily stored in automatic data processing equipment and programmed for retrieval in various formats to identify technical problem areas, support budgetary and manpower needs. In fact, the resources expended on ship's maintenance at the organization and intermediate level as reported through the 3-M System are being planned for use under the Resource Management System (Impact) to support budgetary requirements.[2]

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[1]U. S., Department of the Navy, Office of the Chief of Naval Material Instruction 5000.6, Configuration Management, 1 February 1966.

[2]DOD Instruction 7000.1.

There is not a single vehicle yet devised to suit the ✓ requirements of configuration management. This kind of information is in many independent identification formats at numerous support activities. Even at this date, with many new ships, aircraft and weapons systems being conceived on the basis of their life cycle costs, there is still lacking a uniform approach which should be the basic building blocks for configuration management to support the concept, design, construction, operation, and maintenance phases. A case in point is the cost and weight information for the LHA Project. Here all past data of this nature are identified under a coding structure known as the Bureau of Ships consolidated Index of Drawings, Materials and Services Related to Construction and Conversion. On the other hand, all maintenance data on active ships are now being accumulated under the Equipment Identification Code for purposes of reporting under the 3-M System. There is apparently no effort being made to make the forms compatible with the latter and, hence, the actual cost of maintenance in the future cannot be applied to develop new ship concepts and their life cycle costs. Also, costing of concepts now being developed will not be verifiable in future operations.

However, 3-M data do contribute to the identification of requirements for follow on/replacement equipment and support the determination of maintenance requirements in the research phase. 3-M documentation is of use in the development of the configuration

description in the concept formulation phase by relating previous experience to new design. It contributes to better description of maintainability and reliability specification in the contract definition phase, and can assist in measuring maintainability, reliability and provisioning decisions in test and evaluation actions. The 3-M System is a source of information relative to total production requirements, and can provide information relative to introduction of these new equipments/systems into the fleet. Finally, 3-M documents maintain and support experience data in the operational phase of the life cycle and hence continue to accumulate data for further application in follow on life cycle events.

CHAPTER V

CONCLUSION

A conceptually sound and effective management information system is one that provides the resources for the generation, collection, analysis, storage and retrieval of data to support management in the functional areas of planning, decision-making, reporting, and control. To be of true value to management, information must be timely, complete and accurate. The system should be designed so as to reduce input redundancy thereby reducing the burden placed on the operating level. Additionally, the system should provide outputs designed to the needs of the user.

Based on the preceding evaluation, the 3-M System fails, however, to fulfill many of the precepts of a conceptually sound management information system, as outlined in this paper.

The purpose of 3-M is to serve management in the achievement of those overall objectives of the Navy to which management is dedicated. The overall objectives of the 3-M System have become somewhat obscured through the fragmented statements of these objectives, or reference to secondary

objectives, in the many instructions and documents pertaining to the system.

The 3-M System was not initially envisioned as an independent maintenance and material management program, but rather it was designed to serve specific needs of maintenance personnel within the operating forces. However, it possibly has gained identification as a "pedestaled" system through its "semi-special project" status.

One of the essential ingredients of the 3-M System is the visibility it can provide managers at all levels into the daily material support problems confronting the operating forces. This span of vision can and often does result in improved distribution of skilled manpower, improved material support, more efficient use of available manpower and material, improved engineering practices, better maintainability and reliability of installed equipments and weapon systems. The system has produced many benefits during its relatively short existence. These benefits are being realized in varying degrees; some are being actively sought but require time to achieve; some are dependent on full implementation within the depot levels of maintenance.

Defining products needed by the user is a major problem. Although a user's survey was utilized prior to initiating the system, there still appears to be a lack of understanding as to what data are available in the system and what data are required

by the user. Requirements are defined in general terms for notional or an abstract representation of the class of users. In order for the system to function effectively and provide the information required at all levels, management must reconsider its objectives and more clearly define its requirements.

Although the Supply and Ships Systems Commands have established programs bent on utilizing 3-M data for Allowance List construction and configuration management, the data elements collected appear to be incompatible with on-going programs. For example, there is not a convenient way to relate the functional based Equipment Code to the design based component Identification Number used in the Allowance List program. Incomplete, inaccurate, and extremely late data presently generated by the system have lessened management's enthusiasm and obviously reduced the system's effectiveness.

In an effort to gather information and develop a broad data base the system imposes an unnecessary reporting workload on the operating forces. The 3-M System requires the reporting of data which can be, and often are, provided by computer inputs vice reporting activity inputs. Such elements as the administrative organization to which the reporting activity belongs or the unit of issue and price for material used, can be readily maintained in the computer. Required reporting of all scheduled preventive maintenance actions accomplished aboard ship imposes an unnecessary burden, when reporting on an exception basis would serve the same purpose.

It is found in some instances that organizational arrangements are not sufficiently well documented to insure the necessary recognition of responsibilities as they pertain to the continued development and administration of 3-M.

The system relies heavily on data which may be error-ridden, and erroneously derived. The only way that these data can be purified is through actual use which reveals data deficiencies. Extensive cross referencing of supply data to maintenance actions is introducing errors into the data bank. It is obvious that the authority and usefulness of MSO's data products are highly dependent upon the validity of the data injected into the system. "Garbage in, garbage out" is a trite but nevertheless true adage.

The interval between the actual reporting of data and the production of data reports by MSO is on the order of two to five months. At best these untimely reports contain only three-fourths of the data germane to the maintenance actions for a given time period.

Interface problems among the 3-M System and other information systems in the Navy Department and Department of Defense are apparent and require close management attention in order to avoid needless redundancy and unnecessary collecting and maintaining of data. A detailed analysis of management informations systems in the Navy should be made to insure

integration of the 3-M System within the Navy and to insure optimum compatibility of all systems.

The 3-M System has not yet reached its full potential as a management or management information system. It has, however, in the time since its initial development, become an essential tool to Navy managers in the attainment of specific objectives.

As in any system, modifications are required as the system progresses. However, more fundamental to the realization of a responsive and effective information system is the disciplined use of the system at all appropriate levels of management. Only in this way can the full potential of the 3-M System be realized.

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